APPENDIX 4A:
Waste Disposal Options for the Luckey Site

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APPENDIX 4A. WASTE DISPOSAL OPTIONS

This appendix summarizes waste disposal options for soils excavated from the Luckey site. The different waste streams, as described in Appendix 3B, consist of the following:

- solid waste (beryllium-only contaminated soils)
- Formerly Utilized Sites Remedial Action Program (FUSRAP) radioactive waste (radiologically contaminated soils)
- hazardous or mixed waste (soils containing hazardous constituents).
  The term "*mixed waste,*" as used throughout this appendix, is defined as: *RCRA hazardous waste with radioactive residuals that are not NRC regulated*. This includes 1) RCRA hazardous wastes containing radioactive residuals at activities acceptable for disposal at a RCRA permitted disposal facility, and 2) RCRA hazardous waste containing radioactive residuals at activities requiring disposal at a RCRA disposal facility that is both permitted and licensed."

The disposal sites listed below could accept a portion of waste from the Luckey site. The solid waste facilities listed below either have contracts with the United States Army Corps of Engineers (USACE) to accept FUSRAP waste or have expressed interest in the non-radioactive waste. Prior to the disposal of any waste from the Luckey site, all procedures detailed in EC 200-1-3 (*Offsite Disposal of Materials from the Formerly Utilized Sites Remedial Action Program*) will be followed to ensure waste is properly handled and disposed.

4A.1 SOLID WASTE DISPOSAL FACILITIES

Soils not containing elevated radiological activity levels could be disposed at a facility which is not specifically licensed or permitted to accept FUSRAP waste. This might include facilities within the State of Ohio. Beryllium-only contaminated soils at the Luckey site are not considered hazardous under the Resource Conservation and Recovery Act (RCRA) regulations and therefore could be disposed at municipal solid waste facilities or even at hazardous waste facilities as a non-hazardous waste stream.

A number of facilities in the Toledo, Ohio area have expressed interest in the non-radioactive solid waste streams. The Ohio Environmental Protection Agency (Ohio EPA) has indicated it might be possible to dispose this waste in a licensed facility within the state. The advantage of these facilities is that transportation charges would be minimal and disposal charges would be reduced. Two facilities within Ohio have been identified and have expressed interest in receiving beryllium-only and hazardous waste streams: Envirosafe Services facility in Oregon and the Evergreen Recycling facility in Northwood. Other facilities also may be available for disposal of the non-radioactive waste stream; however, disposal fees are not expected to vary significantly and transportation costs would be higher.

Envirosafe Services of Ohio, Inc.
Oregon, Ohio

This is a subtitle C facility which can accept hazardous and non-hazardous waste. The contact is familiar with Luckey waste as this person arranged for Luckey investigation derived waste (IDW) to be disposed at their facility in Idaho (since sold to U.S. Ecology). A preliminary evaluation indicates the beryllium-only waste stream will meet the facility's waste acceptance criteria. Disposal costs are estimated in the $40 to $50/ton range with transportation at $10/ton.

Evergreen Recycling & Disposal
Northwood, Ohio

This is a subtitle D facility that only can accept non-hazardous waste, i.e., solid waste.

4A.2 FUSRAP RADIOACTIVE WASTE/MIXED WASTE DISPOSAL FACILITIES

Several facilities were evaluated that could potentially accept FUSRAP-related radioactive waste from the Luckey site for disposal. Radiological activity levels limit the number of facilities that can accept this type of waste. The waste also may contain beryllium at levels above background; however, beryllium-contaminated soils at the Luckey site are not considered a hazardous waste. Only facilities that could accept waste with an activity greater than 30 pCi/g were identified. Four facilities met this criterion, although one was subsequently eliminated. The remaining three facilities include Envirocare of Utah, U.S. Ecology's Idaho Facility, and WCS of Texas. These facilities constitute the short list of potential disposal facilities for FUSRAP radioactive waste and/or mixed wastes from the Luckey site.

Envirocare of Utah
Salt Lake City, Utah

This is a Subtitle C facility that can accept regulated waste (11[e]2, low-level radioactive waste (LLRW), low activity radioactive waste (LARW), naturally occurring radioactive material (NORM), naturally occurring or accelerator produced radioactive material (NARM), mixed waste treated, or mixed waste needing treatment). The facility has worked with USACE in the past and was used extensively for disposal of FUSRAP waste under Department of Energy (DOE).

Analytical information is required to profile the waste prior to acceptance. The waste also must be screened for oversized debris. Material within the waste must be less than eight inches in at least one dimension and no more than eight feet in any dimension. The waste also cannot contain free-standing liquids. Activity limitations vary by isotope, but are one to two orders of magnitude higher than the highest detections at the Luckey site (Section 4 of Remedial Investigation (RI) Report, USACE 2000a).

Under the USACE Kansas City contract, disposal costs for FUSRAP radioactive waste shipped via intermodal containers are at least $103.77/cubic yard (cy) based on weight/density. This does not include transportation of the material or rental of intermodals. The Buffalo district has paid $71.76/cy and $80.00/cy for disposal of FUSRAP radioactive waste shipped from Linde and Ashland, respectively.

Disposal of mixed waste shipped via intermodal containers under the USACE Kansas City contract are estimated to cost approximately $457.73/cy based on weight/density.

U.S. Ecology, Idaho Facility
Grandview, Idaho

This Subtitle C facility is permitted to accept waste with an activity level up to 0.15 mrad/hr. This is equivalent to approximately 200 pCi/g of radium-226. Based on site-specific sampling data, this limit should be well above the actual activity of the FUSRAP radioactive waste from the Luckey site. The facility must receive a letter from the lead agency stating the waste is not Nuclear Regulatory Committee (NRC) regulated. The only additional information required for profiling waste is "generator knowledge." Additional analytical data are anticipated. This facility has accepted IDW from the Luckey site in the past.

Disposal costs, under the Kansas City USACE contract are $71.5/cy for FUSRAP radioactive waste. This does not include transportation of the material or rental of intermodals. Any container that might contain free-standing liquids must be crushed and tires must be quartered or removed.

Disposal of mixed waste meeting the standards of the Idaho state hazardous waste regulations would cost $97.5/cy.

WCS, Texas
Texas

The Kansas City USACE disposal rates for 11(e)(2) waste shipped via intermodal containers is $75/cy based on weight/density. This rate assumes the waste meets licensing criteria and requires no moisture conditioning or other special handling.

4A.3 DISPOSAL SITES SCREENED OUT

The following facilities could accept some activity level of radioactive waste, but were eliminated from consideration for the reasons described below.

Chemical Waste Management
Model City, New York

This facility will consider accepting FUSRAP radioactive waste with activity levels less than 20 to 25 pCi/g. The facility has accepted other FUSRAP wastes in the past. For wastes containing higher activities, they recommend their Chem Nuclear facility in South Carolina. The South Carolina facility was not accepting waste outside their compact area when contacted. The facility will obtain approval letters from EPA and NRC before accepting waste, whether it is a FUSRAP waste or not. Approval procedures require two to three months. This facility did not pass the 30 pCi/g screen.

Dawn Mining
Ford, Washington

This facility can accept only 11(e)2 material. Waste must be enclosed in a flexible container or bag and must be trucked from a rail siding. Due to the classification requirement, this facility was eliminated. (FUSRAP material is similar to 11(e)2 but predates the classification and so is technically not considered to be 11(e)2 material.)

ECDC Environmental
East Carbon, Utah

This Subtitle D facility accepts certain (unspecified) activity levels of radioactive material. Utah allows disposal of radioactive material in a solid waste landfill if the material is not regulated in the state of origin. Before accepting the waste, the facility requests analytical data be sent to the Utah Division of Radiation Control, Department of Environmental Quality (DEQ). If that office certifies the waste is below the acceptable activity level, ECDC will consider accepting it for disposal. Due to the uncertainty of acceptable activity levels in waste, this facility was eliminated.

Peoria Disposal Company
Peoria, Illinois

This is a Subtitle C landfill. The landfill does not accept radioactive waste, however, it does have a brokerage department that assists people in locating disposal sites. A company representative indicated Illinois solid waste landfills cannot accept LLRW. Because this facility could not accept radioactive waste, it was eliminated from further consideration.

Safety Kleen
Pinewood, South Carolina

This facility accepts NORM waste. It accepts LLRW on a case-by-case basis using certain narrow criteria. However, it can accept only mixed waste with additional restrictions. Due to the restrictions on acceptable wastes this facility was eliminated from further consideration.

Safety Kleen
Waynoka, Oklahoma

This Subtitle C facility can accept non-regulated radioactive material up to an activity level of 30 pCi/g. The process for acceptance requires submittal of a waste profile and a non-hazardous affidavit. No letters of approval are necessary. The approval process should take a couple of days. This facility met the initial 30 pCi/g screening criterion, but was eliminated because the state indicated it would not approve disposal.

Safety Kleen, Deer Trail, Inc.
Henderson, Colorado

This Subtitle D facility is allowed to accept radioactive materials less than background activity levels, which are 16 micro-roentgens per hour. The company representative suggested a straight reading of the material be performed to see if it would qualify. This facility was eliminated from further consideration because of the low threshold of acceptable radioactivity.

APPENDIX 4B:
Transportation Alternatives Assessment

U.S. Army Corps of Engineers

FUSRAP

Luckey FUSRAP Site
Luckey, Ohio

Final
Transportation Alternatives Assessment

Prepared for

U.S. Army Corps of Engineers
Buffalo District
Buffalo, New York

Total Environmental Restoration Contract
DACW27-97-D-0015 Task Order 0009

May 2003

MWH

TRANSPORTATION ALTERNATIVES ASSESSMENT

LUCKEY FUSRAP SITE
LUCKEY, OHIO

May 2003

Montgomery Watson Americas, Inc. (MWH) certifies that, to the best of its knowledge and belief, the technical data delivered herewith under contract DACW27-97-D-0015 is complete, accurate, and complies with all requirements of the contract.

Prepared by: MWH - Environment and Infrastructure
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1.0 INTRODUCTION

This appendix assesses feasible alternatives to transport an estimated 93,000 cubic yards of waste materials from the Luckey, Ohio Formerly Utilized Sites Remedial Action Program (FUSRAP) site to a possible permanent disposal facility located in Utah (Envirocare of Utah, Salt Lake City) or Idaho (US Ecology, Grandview).

FUSRAP waste materials include solid waste (beryllium only or radioactive with beryllium), FUSRAP radioactive waste (radioactive material alone), RCRA hazardous waste (lead alone or with beryllium; radioactive, lead and beryllium), and mixed waste (radioactive with lead). The material to be transported is referred to as "FUSRAP waste" throughout this appendix. It consists of solids and soils. Liquids are not discussed in this assessment.

Three methods for transporting the FUSRAP waste are identified – truck, rail, and intermodal transportation. Further, each method may employ bulk means (gondola cars or dump trucks) or contained means (intermodal containers or flexible (bag) containers) for moving the FUSRAP waste.

Detailed routing from the site to the Interstate Highway System is provided for the trucking method, and from the site to the point of loading railcars for the rail and intermodal transportation methods.

Several alternatives using these transportation methods are considered and evaluated for a variety of factors that affect the attractiveness of each alternative. Figure 1 is a map that shows the various alternative routes (labeled A through H) considered in this appendix.

Costs for transporting the FUSRAP waste are estimated from portal to portal, excluding Luckey site excavation work, dumping charges, and (if needed) transfer station post-project monitoring.

2.0 RECONNAISSANCE VISIT

Two engineers from Montgomery Watson Harza performed a reconnaissance visit to the Luckey, Ohio site on November 1 and 2, 2001. Separate informal meetings were conducted with Mr. Anthony Allion, Wood County Engineer, at the county offices in Bowling Green and with Mr. Don Sprandel, CSX Terminal Superintendent, at their Walbridge, Ohio yard.

The Wood County Engineer provided a detailed county road map, permit information, and preferred roadways. His preference is for the use of state or county roads, since these generally are wider and in better condition than local or township roads. Copies of selected real property maps were provided for areas considered for transfer sites in Troy Township (Alternatives C and D).

The CSX representative indicated that contaminated soils have been transported via the Walbridge Yard, and he suggested that the old UPS site in the Walbridge Yard be considered as a transfer site. He also indicated that a site closer to Luckey be used in order to reduce the haul, isolate the transfer activity away from a more congested area, and to improve public opinion. Alternative sites A, B, C, and D meet CSX's suggestions for transfer site usage.

The routes from the Luckey site to several prospective transfer station locations were traversed during both days of the visit to obtain pertinent information about the advantages and disadvantages of each routing path and transfer site. Some photographs were taken at select potential transfer station sites.

3.0 TRANSPORTATION METHODS

The generally accepted methods for transporting bulk or contained materials are truck, rail, and intermodal containers. All three methods are available to transport FUSRAP waste from the Luckey site. Haulers must be certified, and the appropriate equipment used and procedures followed.

Note that all three methods include containers that have open tops. Trucks and railcars would be lined with polyethylene sheeting as needed; and covered with specially designed tarpaulins, hard covers, or the polyethylene sheeting to prevent the release of FUSRAP waste while transporting.

The vehicles and containers discussed in this appendix are identified in Table 1. Since most of these are known or referenced in terms of their volumetric capacities, use of the volume of the vehicle enclosure can be confusing and misleading with respect to the Luckey FUSRAP waste. The FUSRAP waste unit weight (130 lbs/cubic foot) results in the inability to fill the enclosed container volumes before the material weight surpasses the load limits of the roads or the structural load limit of the container/vehicle. The limiting factor for the transported capacity, then, is the weight of the material or the structural load capacity, rather than the volumetric capacity of the containers.

For example, from Table 1, an IP1 container can hold 25.4 cubic yards within its enclosed volume, but the Wood County roadway load limit (80,000 lbs. gross, 72,000 lbs. net) reduces the amount of Luckey FUSRAP waste that can be transported in one IP1 to 20.5 cubic yards by weight.

3.1 TRUCK

The truck transporting method involves loading FUSRAP waste at the site into intermodal containers (20.5-cubic yard capacity, by weight) or flexible containers (6.8-cubic yard capacity, by weight), which are then lifted onto truck chassis for hauling to the permanent disposal facility. Alternatively, the FUSRAP waste may be direct bulk-loaded into trailer-type dump trucks (20.5-cubic yard capacity, by weight).

3.2 RAIL

The pure rail method of transporting Luckey FUSRAP waste requires extending a new track southward from the terminus of an existing privately owned two-mile section of track (itself an extension of a CSX line) at the Village of Stony Ridge to the Luckey site, a distance of 3.1 miles. FUSRAP waste is loaded either in bulk directly into high-sided gondola cars (148-cubic yard volumetric capacity) for shipment or loaded into intermodal containers (25.4-cubic yard volumetric capacity) that are then lifted onto intermodal

railcars such as Articulated Bulk Commodity Flatcars (ABCs) with a 177-ton weight capacity. These railcars are hauled the full distance to the permanent disposal facility, estimated to be 1,500 miles from Luckey.

Note that higher capacity low-sided gondolas (Table 1) are not generally used in FUSRAP waste transport efforts because the cars cannot be unloaded easily at permanent disposal facilities.

3.3 INTERMODAL TRANSPORTATION

The intermodal transportation method combines the trucking of FUSRAP waste from the site in containers (20.5-cubic yard capacity, by weight) to a nearby transfer station, where the containers are lifted onto standard intermodal railcars (such as ABCs) for the remainder of the trip to the permanent disposal facility. Alternatively, trailer-type dump trucks can be bulk-loaded at the Luckey site, unloaded onto the ground at an off-site transfer station, then front-end loaded into intermodal containers and ABCs or front-end loaded in bulk into high-sided gondola cars for the balance of the trip to the disposal site.

Flexible (bag) containers (such as "Lift-Liners™") are a variation of the standard intermodal method of transport. It combines flatbed trucking of soils from the site in flexible containers (9.6-cubic yard volumetric capacity, 6.8-cubic yard, by weight) to a nearby transfer station, where the containers are lifted into high-sided gondola railcars for the remainder of the trip to the permanent disposal facility.

Use of bags eliminates the difficulty of staging intermodal containers in sufficient numbers to support a large removal project ("FUSRAP Experience Transporting LLW and 11e(2) Waste Materials by Rail, Intermodal Container, and Truck (Transportation)", by P.W. McDaniel, G.J. Borden, and M.R. James).

3.4 FACTORS AFFECTING TRANSPORTATION FEASIBILITY

The truck, rail, and intermodal transportation methods can be applied to numerous scenarios for executing the transport of FUSRAP waste. Alternatives include a number of existing or potential transfer stations operated by the railroads (CSX and Norfolk-Southern) or private property owners, and a number of public roadway routings for trucks. Each alternative considered in this appendix is evaluated with respect to a number of factors that are described in the sub-sections below.

The evaluation factors include a wide variety of subjects, some more important than others. Any decision concerning the choice of transport method for ultimate implementation must consider the relative importance of the evaluation factors, with emphasis given to those factors deemed most important.

Community participation in the remediation of FUSRAP sites places great importance upon factors that impact public health and protection of the environment, and less importance on political factors ("Case Studies of Community Relations on DOE's Formerly Utilized Sites Remedial Action Program as Models for Superfund Sites," by S.W. Plant and D.G. Adler). In this regard, the most important transportation evaluation factors are assumed to be residential area impacts, traffic and accidents, and schedule. The next group, of moderately high importance, is cost, haul length, and need for site improvements. Least important factors for the Luckey site are monitoring, road geometrics, government approvals, and railroad approvals. For the least important group of factors, it is not that the factors are unimportant, but rather they are fairly constant in their need between alternatives, thereby not figuring heavily in the decision for the recommended alternative for implementation.

Table 2 provides a matrix of the evaluation factors, ranking each factor from least important, (1), to most important, (13). Below each factor is a score for each alternative for each factor, ranging from least favorable, 1, to most favorable, 5. The score is intended to estimate how easily the factor can be met for each alternative. Thus, high scores for the most important factors suggest the better transportation alternatives.

3.5 SIZES AND TYPES OF TRUCKS AND RAILCARS

Bulk transportation of 93,000 cubic yards of FUSRAP waste favors the use of a larger capacity vehicle to reduce the unit cost for hauling and to enhance safety by reducing the number of hauls. For this reason, ordinary small capacity dump trucks are not considered in this appendix. Instead, 20.5-cubic yard capacity (by weight), trailer-type dump trucks will be used for the truck alternative.

Gondola cars and intermodal containers allow railroads to haul bulk materials in cars of a variety of capacities to suit material and customer needs. The railroads have indicated that they have transported contaminated soils in 148.1-cubic yard high-sided gondolas and by 25.4-cubic yard intermodal (IP1) containers. These volumetric capacities are used in this appendix to identify the size vehicle being used. Refer to the next paragraph for discussion of vehicular capacities based on weight limitations on railroads and roadways.

Table 1 shows that the weight of the waste, or roadway or rail roadbed load limits, govern the capacity that can be transported in each container. The actual maximum transport volumes (by weight) that are used in this appendix are provided in this table.

3.6 LOCATION OF TRANSFER SITES

Transfer stations are centrally located facilities that generally receive bulk materials from the surrounding area in smaller quantities per load, stockpile it, and then re-load it into

larger capacity vehicles for transport to a distant final destination. These stations facilitate cost effective hauling.

Since the Luckey FUSRAP waste is contaminated, off-site intermediate stockpiling of material may pose long-term monitoring and exposure issues. These issues are avoided by eliminating bulk material stockpiles from transfer station operations. This is achieved if the transfer station receives containerized or bagged bulk material on truck beds and simply transfers the containers or bags onto intermodal railcars (ABCs) or gondolas for the journey to the permanent disposal facility. Since trucks and containers are cleaned before departing the Luckey site, the transfer station will remain uncontaminated if containers or bags are used.

Transfer sites eliminate the need to extend rail lines onto the Luckey site. Further, some alternatives considered herein include the use of existing transfer stations, which further reduces or eliminates site work. These transfer sites are at various distances from the Luckey site, and have varying existing conditions that affect their relative attractiveness. Generally, a short haul distance combined with minimal site work is very favorable for implementation. The length of haul is a major transportation cost consideration, as well as a traffic safety concern. Site work at alternative transfer station locations is a major cost incurred *before* any waste is hauled. Site work is included in the discussion of the subsection below.

3.7 NEED FOR RELATED IMPROVEMENTS

Some related site improvement work might be necessary to ready the Luckey site, transfer site, or route. The evaluation of alternatives gives due consideration to factors such as (1) the presence of a paved staging and loading area of adequate size, (2) the ease of access into or out of the site, (3) the number and length of track sidings, (4) whether track must be upgraded or repaired, (5) the need to construct new mainline track, (6) the need to clear and grub, (7) whether excavation or fill is needed, (8) the need for structural improvements, (9) the presence of utilities or utility conflicts, (10) the need for security and lighting, and (11) the need to restore the site to its preexisting condition.

If a new rail siding is needed, the railroad will need to approve the design and they will identify the extent of the work that their labor force will complete. Generally, the railroad will place the upper foot of ballast, ties, and rails, and the contractor will place subballast and any other embankment or excavation work.

The length of a new siding must accommodate at least one day's intermodal activities. If production is about twelve 20-foot containers per day, then two or three ABC cars (90 ft long each), and at least 270 feet of siding is needed to meet the end-to-end length of the ABC cars. For estimating purposes, it is recognized that staging empty ABCs and fully stacked ABCs require more siding length. The minimum siding length is taken to be 1,300 feet to allow for locomotives, switch, and some modest space for additional ABC

cars. Gondolas, at 50 ft long each, enable the equivalent of about 27 gondolas to be staged in 1,300 ft of siding.

The length of the bituminous paved transfer station needs to match the length of the day's production in order to minimize railcar movements, so assuming the transfer station pavement equals the siding length, 1,300 feet, is conservative. The transfer station width must accommodate truck access and movements, as well as stockpile of empty containers, filled or empty bags, or loose bulk FUSRAP waste. Two hundred feet of width is adequate.

3.8 ADEQUACY OF EXISTING ROADS

The area immediately surrounding the Luckey site is served by a series of public roads that are under the jurisdiction of the local villages, townships, Wood County, or the State of Ohio. The area is largely rural. Roadways follow a one-mile grid system, with most intersections at 90-degrees. Exceptions to the grid system include the various small hamlets and villages that have more frequent residential and commercial street systems, frontage and service roadways adjacent to the major rail yards located about 7 to 10 miles north of Luckey, and the Toledo metropolitan area. Refer to Figure1 for a street map for the Luckey site vicinity.

Road construction generally consists of bituminous concrete pavement, one 11 or 12-foot traffic lane in each direction, no median, crowned centerline, narrow (two-foot or less) aggregate or soft shoulders or no shoulders, and very steep roadside drainage ditches. Exceptions include Interstates 75 and 80/90 and a section of Ohio Route 795, which are limited access freeways. Local and township roads are generally inferior in width and condition to county or state roads.

Differing roadway geometrics, existing conditions, and traffic and accident history from route to route help discriminate between alternatives based on physical roadway attributes and experienced safety records.

3.8.1 Geometrics

The flat terrain and the roadway grid layout translate into adequate vertical profiles and horizontal alignments. Turning radii at some intersections are inadequate for truck movements without local widening. Large roadside ditches in close proximity to the traffic lanes pose a significant hazard to errant vehicles along some area roadways, threatening the loss of material in the event of an accident.

3.8.2 Condition

The condition of the project area bituminous concrete roads corresponds to their respective jurisdiction. Local roads within village limits are maintained in good condition in the

project area, but these roads are generally avoided as trucking routes due to moderately dense population, the presence of schools or parks, and the logistical difficulties associated with soil cleanup after an accident. Township roads in rural areas are generally weathered and cracked, and are not rehabilitated as frequently as county or state roadways, probably due to funding constraints. County roads are generally in good condition, with evidence of very recent rehabilitation along vicinity roads such as Stony Ridge.

As for state routes, they fall into two groups in the project area - divided and undivided, but only two of these routes happen to be located near the FUSRAP waste transport routes from the Luckey site. Ohio 795 is divided, has been constructed within the last couple of years, and is in excellent condition. Ohio 582 is undivided, and the pavement is about ten years old, shows wear and cracking along the edge of pavement, and receives east-west traffic that is destined for Exit 187 of Interstate 75.

3.8.3 Traffic and Accidents

An inquiry was made to the County Engineer of Wood County for recent traffic and accident data available for selected roadways in the area. The County Engineer has provided data for the anticipated affected township, county, and state roads. This information is provided in Table 3.

The Luckey site area may be described as rural, with few generators of traffic in the immediate area, since few industrial, commercial, or retail land uses are present. Typical local destinations are schools and churches, with some commerce associated with the small villages in the area. The Interstate 75 interchange is a portal for local motorists to enter the regional limited access highways that serve the Toledo metropolitan area. Lower density residential areas and less traveled, lower accident rate roads are preferred for the transport of Luckey FUSRAP waste.

Table 3 indicates that traffic is very low in the immediate project area, say, south of Ohio 795, apparently making these roads most attractive for FUSRAP waste transport. Further north however, beginning at Perrysburg, communities grow larger and rural land uses are displaced by residential, institutional, commercial, and industrial developments. This area of northern Wood County and southern Lucas County is part of suburban Toledo, with higher traffic volumes than points to the south. Three major rail yards are found in the Walbridge area, with several existing or potential transfer sites in the yards available for consideration to receive FUSRAP waste from the Luckey site.

Table 4 provides a normalized account of area traffic and accident rates, by developing an accident rate per million vehicles for the latest year available, 1998. Rates are added to reflect an approximate accident rate along the routes for each alternative. Alternative routes that use Luckey Road primarily (B and D) appear safest. East Broadway at US 20/23, within the community of Stony Ridge, is most accident-prone. This location has an offset intersection, which would appear to account for the high rate of accidents.

Railroad accident rates are significantly less frequent than roadway vehicle accident rates. Since 1991, train crashes have reduced (despite a doubling of freight ton-miles), while truck accidents have increased (with a modest increase in truck ton-miles). Data for 1997 from USDOT show truck and train accidents to be 3,767,000 and 2,397, respectively ("Waste Maximization", by K. Grumski of MHF Logistical Solutions). There were 1,571 times more truck accidents than train crashes in that year. Therefore, rail transport of FUSRAP waste is preferred for the long distance haul to the permanent disposal facility in Utah. The longer the truck haul, the less attractive the alternative is for transporting FUSRAP waste.

3.9 IMPACTS TO RESIDENTIAL AREAS

All alternatives considered in this appendix, except the rail-only alternative, require the truck transport of FUSRAP waste on the local road system. It is preferred to route trucks to avoid or minimize residential areas for several reasons: (1) higher traffic in the residential areas will increase truck travel time and, consequently, increase haul costs, (2) increased chance for vehicular accidents and exposure of FUSRAP waste into the environment, (3) if an accident does occur, the congestion and presence of other vehicles, narrow roads, and people will make cleanup more difficult, and (4) presence of trucks in larger numbers over the project period heightens people's awareness of the project and erodes their support for the safe removal of the FUSRAP waste.

3.10 GOVERNMENT APPROVALS, REGULATIONS, AND PERMITS

The transport of Luckey soils in Ohio requires permits from Wood County and the Ohio Public Utilities Commission. Both permits provide the government with information such as material type, quantity/volume of material, per truck volume/weight, schedule, route or destination, and guaranty not to damage roadways. Certified haulers must be employed for the work. It is expected that 10 to 20-cubic yard trucks will be used for the transport, resulting in loads no greater than approximately 72,000 pounds per truck, which is less than Wood County's 80,000-pound load limit. Neither excess weight nor oversized loads are expected, so the transport is not route-restricted. Further, some of the FUSRAP waste has low-level radioactive levels that do not require restricted routes due to material type.

The Public Utilities Commission desires the most direct route be used to minimize the haul and exposure on public roadways. The commission also desires that routes avoid residential areas. These two conditions conflict when the most direct route also passes through residential areas. Also, the most direct route might utilize narrow roads or roads in poor condition. The alternatives considered in this appendix represent effective and reasonable compromises between directness, residential areas, and road condition. Obtaining a permit from the commission is not expected to be a problem, provided the route is explained with respect to these parameters.

Rail transport of FUSRAP waste assumes the cars to be placarded as radioactive, if necessary. Placarding constitutes a series of corresponding handling procedures related to loading, movements in yards, and the order of train car assembly.

3.11 RAILROAD APPROVALS

The rail transport of FUSRAP waste requires specific negotiations with the private railroads to obtain their approval to transport the material. For example, the railroad might prefer one existing transfer site to another, or might prefer new sidings or spurs at specific locations along mainlines. Railroads have been contacted regarding the potential use of sites or new spurs, and they have not identified objection or blanket endorsement to any of them, which is appropriate for this level of assessment. For this reason, this appendix identifies several fallback (less attractive) alternatives, which may be pursued if needed.

3.12 PRIVATE PROPERTY LEASES

The cost to use existing railroad transfer stations is included as a two-year lease. For cases when a new spur or siding is constructed (or upgraded) and a staging/loading pad is needed on private property adjacent to the right-of-way, leases with the adjacent property owners are needed for property use or for access.

Avoiding the use of private property eliminates the chance for accidents and the possible liability and long term site monitoring on that property. The alternatives considered for transfer sites minimize the need for private property leases to one parcel whenever possible.

The rail-only alternative (Alternative G) requires numerous leases, making it least attractive regarding this evaluation factor. All other alternatives include small numbers of leases.

3.13 MONITORING

Long term monitoring is possible in the event of an accident during material transport or transfer along the route to the permanent disposal facility. It also may be needed if material is stockpiled at transfer stations.

The need to monitor can be minimized by isolating the material from the open environment by containerizing the FUSRAP waste on-site, or direct loading into gondolas or bags on-site. The material would be wrapped and covered with polyethylene if gondolas are used. Intermodal containers would be lined and topped with specially designed tarpaulins or hard covers. All vehicles and containers would be decontaminated prior to leaving the Luckey site as an ordinary measure to help protect roadways, railroads, private property, and the

environment. Reducing the handling of materials will also reduce the likelihood of accidents and the need for monitoring. Elimination of off-site transfer stations would reduce handling effectively, but would result in the need to transport the material by rail-only or truck-only means, both being costly (See Table 5).

3.14 COST

The cost items associated with transporting the FUSRAP waste includes rental or purchase of specialized lift equipment, container rental, local truck hauling from Luckey to transfer stations, transfer station site work and restoration, unloading and re-loading at transfer stations, rail improvements, long distance rail or truck hauling, liner costs, and property leases.

Costs to excavate, stockpile, and load material on-site and dumping charges at the permanent disposal facility are not included, as these elements are assumed part of other project activities.

Table 5 provides feasibility level cost estimates for transporting FUSRAP waste. Costs are estimated for each of the eight alternatives considered in this appendix. The table clearly shows that the intermodal transportation method is much less expensive than the rail or truck methods. Alternatives involving little site work are more attractive if the volume of FUSRAP waste is less than expected.

3.15 SCHEDULE

Assuming that two calendar years are available for completing the transportation effort, and four months are lost due to winter between the two construction seasons, 93,000 cubic yards of FUSRAP waste can be removed at an average production rate of 233 cubic yards per day (20 days per month times 20 months). This production will be achieved if twelve IP1 containers loaded with 20.5 cubic yards each are filled in each eight-hour day, or about one every 40 minutes.

Those alternatives requiring transfer station site work will need about six additional months to complete the site work before commencing the transport work. It is assumed that the schedule will be extended beyond two years if site work for a new temporary transfer station is needed. The alternatives requiring little or no site work and feature larger lay down areas or longer sidings in yards will complete the transport work easily in two construction seasons.

4.0 ALTERNATIVES CONSIDERED

Numerous alternative transportation routings have been identified in the course of this work. Eight alternatives are discussed. Alternatives A, B, C, D, E, and F are routes for intermodal transportation, which may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola rail cars. The choice of the specific vehicle/container should be made based on safety and cost effectiveness. Alternative G is a route for rail-only transport, and Alternative H is a truck-only route. Existing and proposed transfer sites are identified for the intermodal transportation alternatives.

All alternative transportation routes described below begin at the Luckey site. In parentheses after road names is the jurisdiction of the road: Local, Township, or County, with state and US highways needing no further identification.

4.1 ALTERNATIVE A – INTERMODAL TRANSPORTATION, EXISTING TRANSFER STATION, MAJOR ROADS

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative route follows Luckey Road (C) south 0.1 miles, Ohio 582 west 1.0 miles, Stony Ridge Road (C) north 3.8 miles, US 20/23 east one block, East Broadway (C) north 3.6 miles, Ohio 795 east 1.3 miles to the Luckey Road exit, then Luckey Road (T) south 0.1 mile to the entrance to the existing CSX intermodal site known as the old UPS facility (27670 Luckey Road). The length of the route is 9.9 miles one-way.

The advantages of this alternative include:

- A CSX-owned transfer station that requires little or no site work.
- Work can progress independently of other rail activity.
- No track improvements are needed.
- The length of rail siding is ample.
- Rail movements made easier since the transfer site is at a very large yard.
- Ingress and egress from the transfer station is excellent.
- The site is fenced and partially lighted.
- All but 0.1 miles of the route (Luckey Road) is along county, state, or US roads in excellent condition.

- Passage through residential areas is minimized to one block (US 20/23.
- Roadside ditches are small and no roadway improvements are needed.
- No schools or churches are encountered along the route, although a park is located a few hundred feet west of the proposed transfer site.
- The project schedule can be achieved comfortably with the absence of considerable site work.

Disadvantage of this alternative are:

- The 9.9-mile one-way haul and associated costs.
- The accident rate for East Broadway near the Stony Ridge community is high.

The Table 5 estimated transportation costs associated with Alternative A range from $21,830,000 to $27,440,000, which makes Alternative A the second most economical alternative.

The Alternative A and B (below) transfer station is within the easternmost of three large yards in the Walbridge, Ohio area. Numerous other potential transfer station sites exist at these yards, but are somewhat less advantageous than Alternative A. All three yards feature multiple tracks and siding lengths of two miles or more. The CSX yard to the immediate west of Alternative A transfer station requires site work. The underutilized industrial park sidings further to the west needs track repairs, traffic is more congested, and the population is dense because of the large number of students and staff at Penta County Vocational School and Owens Community College.

4.2 ALTERNATIVE B – INTERMODAL TRANSPORTATION, EXISTING TRANSFER STATION, DIRECT ROUTING

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative is similar to Alternative A, as it uses the old UPS facility as the transfer station, but it follows the most direct route from the Luckey site via Luckey Road.

This alternative route follows Luckey Road (C, T) north 6.6 miles to the old UPS facility. The northernmost 3.1 miles of the route is a narrow township road with deep side ditches. The southernmost 3.5 miles is a county road with similar characteristics. The roadway conditions are a disadvantage of this alternative. The haul length is moderate.

Advantages of Alternative B are the same as Alternative A with respect to the use of the existing transfer station. This route also avoids residential areas most effectively. Traffic counts and accident information indicates this route to be very favorable. The Table 5 estimated transportation costs range from $21,600,000 to $27,220,000, making *Alternative B the most economical alternative*.

4.3 ALTERNATIVE C – INTERMODAL TRANSPORTATION, NEW TRANSFER STATION

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative follows Luckey Road (C) south 0.1 miles, Gilbert Road (T) east 1.0 mile, Lemoyne Road (T) south 0.3 miles, then Ohio 582 east 0.5 miles to a proposed new transfer station in the northeast quadrant of the intersection of Ohio 582 and the double mainline CSX tracks. The length of this route is 1.9 miles.

This alternative requires the construction of a temporary transfer station on private property that is currently in agricultural production. The station would be located on one parcel of land (one lease required) that has over 1300 feet of frontage along the CSX tracks. A new siding track also is required.

The advantages of this alternative include (1) a very small haul length and trucking cost; (2) the top of rail is only about three feet above the adjacent grade, thereby minimizing transfer station fill requirements; (3) the site is isolated from other rail yards, intermodal activities, and truck traffic; (4) passage through residential areas is avoided; (5) only one lease agreement with property owners is needed; (6) no schools or churches are in the vicinity; (7) traffic and accidents are light; (8) immediate access to the mainline exists; (9) ingress and egress from the transfer site can be constructed easily; (10) the Public Utilities Commission guideline to use the most direct route that minimizes haul and exposure to the public is met; and (11) the Table 5 estimated cost to transport is an attractive $24,240,000 to $29,840,000.

The disadvantages include (1) less flexible railcar staging and movements, since the transfer station is not near a yard; (2) high cost to construct the transfer station, then restoration back to a farm; (3) the intersection of Gilbert and Lemoyne needs minor geometric improvements (turning radii); (4) the township road is narrow, (5) the schedule would be longer than two years, due to the construction and restoration work; (6) an existing line of power/telephone poles require relocation, and (7) the accident rate for Lemoyne Road is higher than alternate routes.

4.4 ALTERNATIVE D – INTERMODAL TRANSPORTATION, NEW TRANSFER STATION

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative follows Luckey Road (C) north 0.9 miles, then Garling Road (T) east 1.3 miles to a proposed new temporary transfer station that would be constructed in the northeast quadrant of the intersection of Garling Road and the double mainline CSX tracks. The length of this route is 2.2 miles.

This alternative is very similar to Alternative C, and features very similar advantages and disadvantages. The condition of Garling Road is poor and narrow, making the haul along this road less attractive than Alternative C. A major additional disadvantage to Alternative D is the approximate 10-foot grade difference between the tracks and the adjacent grade. This results in the need for considerably more fill for the transfer station than that required for more similar grade conditions (such as those found at Alternative C). The greater fill results in greater overall costs for this alternative ($26,530,000 to $32,140,000) than most of the other intermodal alternatives.

4.5 ALTERNATIVE E – INTERMODAL TRANSPORTATION, REHABILITATE EXISTING TRANSFER STATION

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative follows Luckey Road (C) north 3.2 miles, US 20/23 west 0.8 miles, and Stockyard Drive south 0.1 miles to an existing private stone material handling facility that is proposed to be used as a transfer station. The length of this route is 4.1 miles.

The present facility is not in active operation. It is served by a two-mile section of privately owned rail that is an extension of the CSX single track mainline. The track and the material handling facility share the same property owner. The track is in poor condition and needs repair. The material handling facility is marginal in size, with the capacity to load only about four railcars before a movement is needed. The length of the rail line is ample for staging railcars, since there appear to be no other users along the existing track. Since the track appears not to have received any use in recent years, there are no competing users and, therefore, the track is fully available for the Luckey project use.

The advantages of this alternative include (1) a short haul length; (2) the existing facility does not require restoration after completion of the project; (3) only one property lease is needed; (4) site work at the material handling facility is limited to a bituminous overlay; and (5) the top of rail and adjacent ground are at the same grade, which eliminates the need for fill.

The disadvantages of this alternative include (1) the need to repair two miles of rail; (2) limited loading capacity at the transfer station; (3) Luckey Road is narrow and has deep roadside ditches; (4) there is some passage through the Stony Ridge residential community and two churches; and (5) the schedule will be a challenge to meet in two construction seasons, despite the reduced need for transfer site improvements, since the siding and transfer site area are smaller than other alternatives.

The Table 5 estimated transportation cost ranges from $24,220,000 to $29,710,000 for Alternative E.

4.6 ALTERNATIVE F – INTERMODAL TRANSPORTATION, EXISTING TRANSFER STATION

Intermodal transportation options may include the use of such vehicles/containers as bulk containers and ABC cars, or gondola railcars. This intermodal transportation alternative follows Luckey Road (C) south 0.1 mile; Ohio 582 west 6.7 miles; I-75 north 16.5 miles, exiting at Exit 203b; US 24 (N. Detroit Avenue) (L) south 1.9 miles; left on Buckingham Street (turns into Fearing Boulevard) 2.7 miles; then left on Hill Avenue (L) 0.1 miles to the entrance to the Norfolk Southern's Toledo Intermodal Terminal (2101 Hill Avenue, Toledo). The length of this route is about 26.1 miles.

This alternative is attractive because of the large expanse of the existing transfer station with little or no work to ready the site for receipt of the Luckey FUSRAP waste. It is also flexible, having a large adjacent yard to facilitate rail movements and two tracks available for loading.

The advantages of this alternative include (1) the readiness and capacity of the transfer station; (2) the ability to make schedule in two seasons; (3) and the adjacent yard facilitates easy rail movements and the site is fenced, lighted, and secured.

Disadvantages include (1) the very long haul length and associated costs; (2) the need to travel along a route that is heavily congested in Toledo; (3) the route passes through several miles of Toledo residential streets with dense population and several schools; (4) the use of Ohio 582 for 6.7 miles, as the road is narrow and has deep roadside ditches; (5) accident cleanup is more difficult and impacts more people and motorists if one occurs anywhere along the route; and (6) likely public and agency opposition to the use of the route.

The Table 5 estimated transportation cost ranges from $28,720,000 to $34,330,000 for Alternative F, making it the most costly of the five intermodal alternatives, but it is still about $15,000,000 less costly than the truck and rail alternatives.

4.7 ALTERNATIVE G – RAIL ONLY, NEW TRACK TO SITE

This rail-only alternative re-establishes an old, abandoned rail line along its original alignment. It follows a 3.1-mile route from the Luckey site north to the end of the private rail line in Stony Ridge, traversing diagonally across over a dozen farms, a couple of minor water crossings of Packer Creek and Crane Creek that likely require culverts, and one larger water crossing of Toussaint Creek that requires a bridge. The same two-mile section of private rail described in Alternative E above requires rehabilitation. Alternative G effectively isolates the transport of FUSRAP waste away from roadways. This alternative route would need roadway grade crossings at Garling, Luckey, Dowling, and Strail Roads.

The advantages of this alternative include (1) the choice to use any type of railcar for the transport of materials, (2) avoids the need for a transfer station (it would require a loading facility at the Luckey site, which is common to all other alternatives anyway), (3) avoids roadway traffic and roadway accidents, except at crossings, (4) contains handling of materials to the Luckey site, (5) eliminates truck hauls off-site, and (6) it is likely to receive favorable support by the public (excluding affected property owners).

The disadvantages of this alternative include (1) the extremely high cost to construct 3.1 miles of new track, then restore it back to agricultural use; (2) the large number of leases that would be needed to use the alignment and to pay for crop damages on parts of parcels isolated by the tracks; (3) the cost to repair the two miles of private track; (4) the cost of water crossings (bridges and culverts); (4) the likelihood that a one-year longer schedule would be needed is possible, and (5) the long distance from main rail yards makes servicing the work in progress more difficult.

The Table 5 estimated transportation cost for Alternative G is very high, ranging from $43,820,000 to $49,160,000, primarily due to very extensive need for rail work.

4.8 ALTERNATIVE H – TRUCK ONLY

This truck-only alternative follows Luckey Road (C) south 0.1 miles, then Ohio 582 west 6.7 miles to I-75 Interchange 187, where trucks enter the interstate system for the remainder of the haul to the permanent disposal facility.

The advantages of this alternative include (1) that only one method of transport is used, eliminating the costs and logistics of routing railcars, (2) transfer stations are not needed, (3) the schedule can be accelerated by increasing the number of trucks and a two-year schedule can be achieved with greater certainty than alternatives using rail or intermodal, provided trucks are available, (4) schools are avoided, and (5) trailer-type dump trucks or intermodal container trucks could be used.

The disadvantages of this alternative include (1) the extreme cost for truck hauling soils to the permanent disposal facility (not an issue if the transport of material will terminate in

Ohio or a nearby state); (2) the use of Ohio 582, a two-lane narrow road with deep roadside drainage ditches; (3) the route passes through the residential area of Dunbridge as well as a church; (4) Ohio 582 traffic is higher than other roads, and (5) the route is highly visible to the public and likely to be looked upon with concern or else opposed.

The Table 5 estimated transportation costs for Alternative H range from $45,410,000 to $47,200,000. Cost drops to $12,400,000 to $14,180,000 if the FUSRAP waste can be permanently disposed of within 200 miles of the Luckey site.

5.0 EVALUATION OF ALTERNATIVES

The eight alternatives presented in this appendix (Alternatives A through H) provide a range of transportation methods and routes that could be used for the transport of FUSRAP waste from the Luckey site. Each alternative has its own unique set of advantages and disadvantages, as described above.

The factors affecting specific alternatives and the final choices of preferred alternatives are identified in Table 2 for comparative purposes. Scoring of the individual factors for each alternative is on a scale of 1 to 5, from least attractive to most satisfactory in meeting the factor. An "NA" is attractive because the factor does not need to be met for the alternative in question. The presence of numerous high scores and "NAs" means that alternative is generally attractive and less problematic. Less attractive alternatives receive a greater number of lower scores. For example, a "5" for traffic and accidents means that traffic and accidents are generally low and not a major concern. A "1" for cost or schedule means that the alternative is relatively costly and that making a two-year schedule might be difficult to achieve.

Table 2 indicates that Alternative A receives a favorable rating on all categories except for the length of haul, which is 9.9 miles one-way. The route follows generally good roads with little impact to residential areas. Accidents appear to be more numerous at US20/23, Stony Ridge Road / East Broadway offset intersection than at other local routes. Alternative A also utilizes an existing intermodal facility that requires little to no site work. Alternative B is similar to A, but the roads are not in comparably good condition. However, Alternative B utilizes Luckey Road, which is lightly traveled, has few accidents, avoids residential areas, and is least costly. To the contrary, Alternatives E and F traverse roads in generally poor condition, have high costs due to length of haul or the need for site improvements, impact residential areas severely, and are costly. Alternative C does not receive as many favorable determinations as Alternative A, but this is not an indication of a poor alternative. The haul is shortest of all alternatives except Alternative G, the poor roads that are traversed are of very short length and reduce the occurrence of accidents, and the cost for transfer site improvements is not quite as high as for other sites needing transfer station improvements. Alternative D is similar to Alternative C, but site improvement costs and the use of poor roads for a greater distance makes this alternative less desirable than Alternative C. Alternative G is an extremely expensive alternative for rail improvements, but maximizes material containment and avoids roadways altogether. Aside from the private property owners whose farms are traversed, it features the least public exposure while the removal operation is happening. It also poses the most challenge to meeting schedule and requires many private property lease/easement agreements. Alternative H does not require a transfer site, but the length of haul all the way to the permanent disposal facility is huge and less likely to occur for the low-level radioactive waste due to the higher chance for an accident. For appropriate waste that may be permanently buried in a disposal site is within 200 miles of the Luckey site (in Ohio or an adjacent state), simple trucking via Alternative H is cost effective.

Figure 2 shows the cost sensitivity of the alternatives to changes in volume of waste. This figure shows that the rail-only alternative (G) and truck-only alternative (H) are much more costly than other alternatives within the range of waste volume expected. Alternative G is more expensive due to the high capital costs involved in constructing new rail line, while Alternative H is more expensive due to the high unit costs of truck transportation. Alternatives involving existing transfer stations (A, B, E, and F) or new transfer station (C, D) are similar in cost within the range of total waste volume expected, indicating that other factors may be more important than cost in selecting among these alternatives. If only a small proportion (20 % or less) of the waste volume will ultimately be disposed out of state, the alternatives utilizing an existing transfer station are preferred, as the capital costs of site improvements are prohibitive for that volume. If a very small proportion of waste is to be disposed out of state (5% or less), truck transportation may be cost effective.

6.0 CONCLUSIONS

Based on the evaluation of alternatives and the series of factors affecting transportation feasibility, it is concluded that the Luckey FUSRAP waste might be transported using a choice of favorable alternative routes that employ intermodal transportation. Varied types of intermodal transportation methods may be employed, namely bulk (gondola), IP1 containers (ABCs), or bags(gondolas).

Since non-radioactive waste soils can be handled more simply than radioactive waste, it can be transported with fewer restrictions, and is less hazardous inherently, so trucking of these wastes is more attractive if permanent disposal is within about 200 miles of the Luckey site.

Final selection of the alternative that will be implemented may be dependent on the volumes of each type of waste soil to be removed. The greater the amount of low-level radioactive soil, the more likely that an intermodal transfer station will be built close to the site so as to reduce the danger of exposure to the public. Lesser volumes of radioactive waste support the moderate hauls to an existing transfer station since exposure and accidents are less likely and the high cost for site improvements is not justified. Very small volumes may make truck transportation feasible, although at a higher risk for traffic accidents.

Table 2 contains several factors that share similar impacts for most alternatives. These factors do not contribute to discriminating between alternatives: size, types of trucks, railcars; road geometrics; and government approvals, regulations, permits.

The remaining Table 2 factors may be divided into two groups. One group contains factors that have costs that can be estimated: the haul length, need for site improvements, and, of course, cost itself. The second group is less tangible, with lesser ability to be cost quantified: road condition, traffic and accidents, residential area impacts, railroad approvals, private property leases, monitoring, and schedule. The second group is no less important than the first, since unresolved issues (such as whether a railroad is agreeable to the specifics of the use of their transfer site or the location of a new site along their mainline) might eliminate an otherwise attractive alternative from use. The more attractive alternatives will feature lower costs and fewer issues with intangibles, especially relative to the factors assumed to be most important in this plan – residential area impacted, traffic and accidents, and schedule. Alternatives A, B, and D score highest in these factors.

7.0 RECOMMENDATIONS

The transport of FUSRAP waste from the Luckey site favors the use of intermodal transportation means to execute the removal, assuming that most of the waste will be disposed out of state. Due to less chance for exposing FUSRAP waste, the use of IP1 containers and ABC cars is the preferred means to transport. If car or container availability is an issue, then bulk transport in gondolas appears to be next best, with bags least favored due to the more intensive labor associated with the bags and the high production volume needed daily to meet schedule.

Assuming out-of-state disposal for most of the site waste, the most attractive alternative is Alternative B, followed by Alternatives A and C. Alternative B avoids residential areas, has little traffic or accidents, can easily meet schedule, and is least costly.

8.0 REFERENCES

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TABLE 1

Vehicle/Container Capacities
Luckey FUSRAP Site
Transportation Alternatives Assessment

VEHICLE/CONTAINER	DESIGN CAPACITY(1)		Limiting Factor (2)	WEIGHT @ FULL TRANSPORT CAPACITY (LBS) (3)	MAXIMUM ACTUAL TRANSPORT VOLUME (CU-YD) (4)
	CU-YD	WEIGHT (LBS)			
IP1 Intermodal Bulk Container	25.4		T	72,000	20.5
Intermodal Bulk Container	25.4		T	72,000	20.5
Type A/7A Bulk Container	25.4		T	72,000	20.5
Type A/7A Cargo Container	37.0		T	72,000	20.5
Model CC-20 Cargo Container	43.0	44800	T	72,000	20.5
Model CC-40 Cargo Container	87.8	67200	T	72,000	20.5
A.B.C. Car		354000	R	354,000	100.9
Low Sided Gondola	101.6	220000	R	220,000	62.7
High Sided Gondola	148.1	193,600	R	194,000	55.2
Flexible Container (Lift Liner, Bag)	9.6	24000	L	24,000	6.8
Trailer-Type Dump Truck		72000	T	72,000	20.5

NOTES:
1. Design Capacity columns indicate the volumetric capacity of the enclosed container and the container's structural weight (load) capacity, if known.
2. The Limiting Factor determines the quantity of material that can be placed into the container and is the smallest load of any component in the transport system. It may be governed by either T (Roadway Semi-Truck pavement load), R (Railroad roadbed load), or L (structural capacity of the Lift Liner).
3. The Weight at Full Transport Capacity is the weight allowed by the limiting factor
4. The Maximum Actual Transport Volume represents the quantity that can be safely transported with due consideration to the Limiting Factor.
5. Unit Weight of FUSRAP Waste = 130 lbs/cu-ft (+/-)

TABLE 2

Summary of Factors Affecting Transportation Feasibility
Luckey FUSRAP Site
Transportation Alternatives Assessment

Alternative	Transportation Method	Monitoring	Road Geometrics	Gov't Approvals, Regulations, Permits	Railroad Approvals	Road Condition	Private Property Leases	Sizes, Types of Trucks,Railcars	Need for Site Improvements	Location of Transfer Site (Haul Length)	Cost	Schedule	Traffic & Accidents	Residential Area Impacted
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	Intermodal	2	4	4	4	4	NA	3	4	3	5	5	1	2
B	Intermodal	2	4	4	4	2	NA	3	4	3	5	5	5	4
C	Intermodal	1	3	4	3	3	4	3	1	4	4	3	2	3
D	Intermodal	1	4	4	3	3	4	3	2	4	4	3	5	3
E	Intermodal	1	4	3	2	3	3	3	3	4	4	2	4	2
F	Intermodal	2	3	3	4	1	NA	3	4	2	4	4	4	1
G	Rail Only	5	NA	5	2	NA	1	5	1	NA	1	2	NA	NA
H	Truck Only	5	1	2	NA	1	5	1	NA	1	1	4	2	3

Notes:
1. Numbers in parentheses suggest importance of each factor, relative to other factors, with (1) being least important, (13) being most important.
2. Scoring of individual factors present at an alternative is on a scale of 1 (least attractive) to 5 (most attractive). "NA" is also a 5.

TABLE 3

Recent Traffic and Accident Data
Luckey FUSRAP Site
Transportation Alternatives Assessment

Location	Vehicles Per Day	Number of Accidents *		
		1996	1997	1998
Ohio 582 west of Luckey	1200	4	4	4
Stony Ridge Road north of Ohio 582	720	1	2	0
East Broadway north of U.S. Highway 20 / 23	1080 near Stony Ridge community; 6480 in Northwood	9	14	10
Luckey Road north of Ohio 582	2040	7	6	3
Ohio 795 in the vicinity of East Broadway interchange and Luckey Road area	12480 to 13560	10	2	10
Gilbert Road in Luckey	360	1		
Lemoyne Road in Luckey area	1200	10	5	7

Source: Mr. Anthony Allion, County Engineer, Wood County, Ohio.
* Number of accidents of all types.

TABLE 4

Route Composite Accident Rate Comparison
Luckey FUSRAP Site
Transportation Alternatives Assessment

Location	ALTERNATIVE								1998 Accident Rate Per Million Vehicles
	A	B	C	D	E	F	G	H*	
Ohio 582 west of Luckey	X					X	NOT APPLICABLE	X	9.1
Stony Ridge Road north of Ohio 582	X								0.0
East Broadway north of U.S. Highway 20 / 23 - Near Stony Ridge community	X				X				25.4
East Broadway north of U.S. Highway 20 / 23 - Near Northwood									4.2
Luckey Road north of Ohio 582		X		X	X				4.0
Ohio 795 in the vicinity Luckey Road area	X								2.2
Ohio 795 in the vicinity of East Broadway interchange	X								2.0
Gilbert Road in Luckey			X						
Lemoyne Road in Luckey area			X						16.0
Route Composite Anticipated Accidents Per Year Per Million Vehicles	38.7	4.0	16.0	4.0	29.4	9.1	0.0	9.1	

NOTE: The traffic count and accident information provided by the Wood County Engineer did not isolate the specific location or severity of accidents. The actual accident rates could vary greatly based on specific geographic location of the historical data provided by Wood County.

* Denotes local component only.

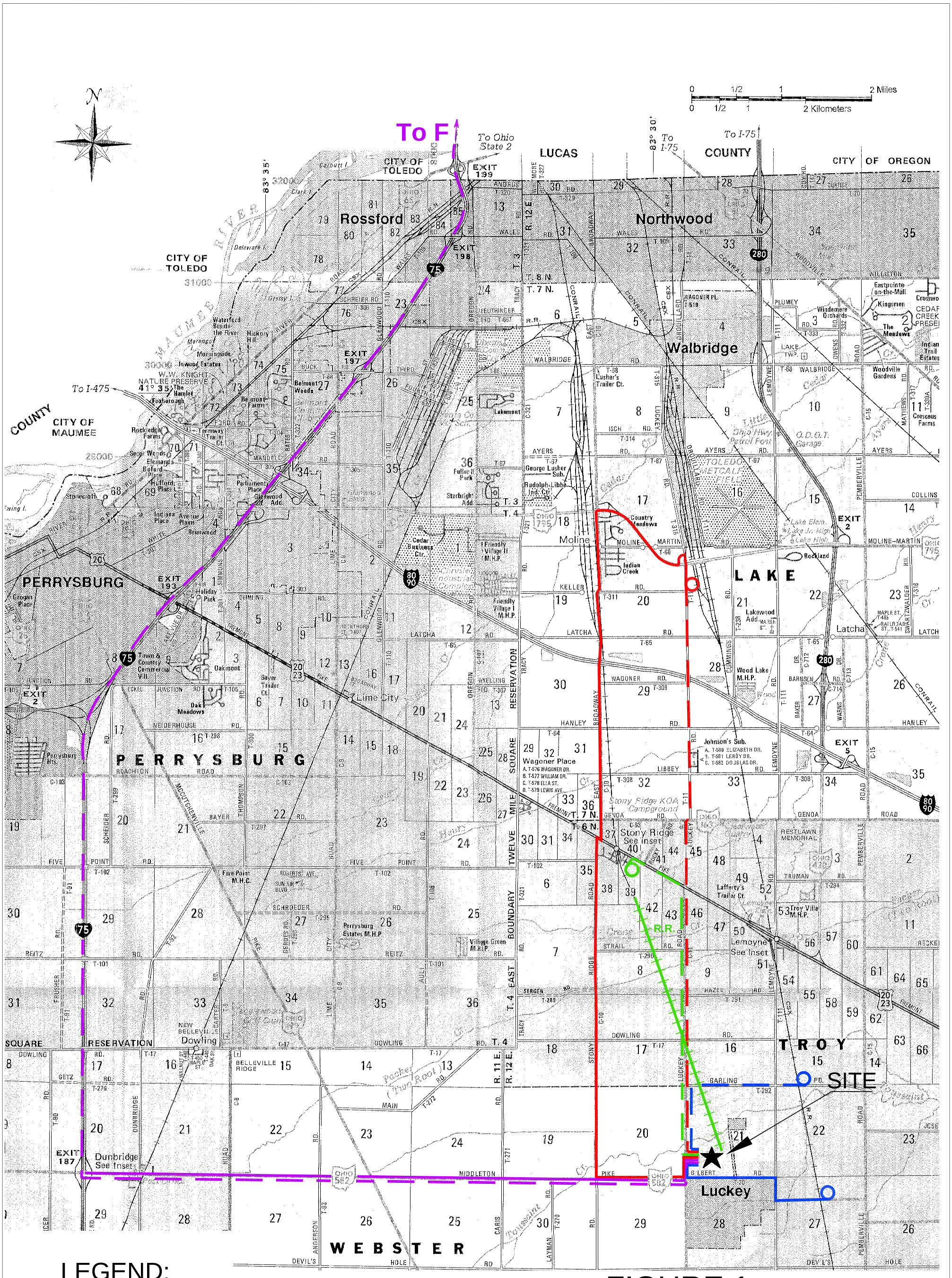
TABLE 5

Transportation Feasibility Cost Estimates
Luckey FUSRAP Site
Transportation Alternatives Assessment

	COSTS (in $ Millions)*								
	INTERMODAL			RAIL			TRUCK		
ALTERNATIVE	IP1 (ABC)	Bulk (Gondola)	Bags (Gondola)	IP1 (ABC)	Bulk (Gondola)	Bags (Gondola)	IP1 (Flatbed)	Bulk (Dump Trk)	Bags (Flatbed)
A	21.83	22.16	27.44						
B	21.6	21.94	27.22						
C	24.24	24.58	29.84						
D	26.53	28.64	32.14						
E	24.22	24.43	29.71						
F	28.72	29.05	34.33						
G				43.82	44.03	49.16			
H							45.48	45.41	47.2
							12.47**	12.4**	14.18**

* Costs include loading at Luckey, local transport, unloading/reloading at transfer station, transport to permanent disposal site, transfer station and rail site work, and site restoration.

** Costs for transport to a permanent disposal site within 200 miles of the Luckey FUSRAP site.



LEGEND:

- ALTERNATIVE A
- ALTERNATIVE B
- ALTERNATIVE C
- ALTERNATIVE D
- ALTERNATIVE E
- ALTERNATIVE F
- ALTERNATIVE G
- ALTERNATIVE H
- TRANSFER SITE (TYPICAL)

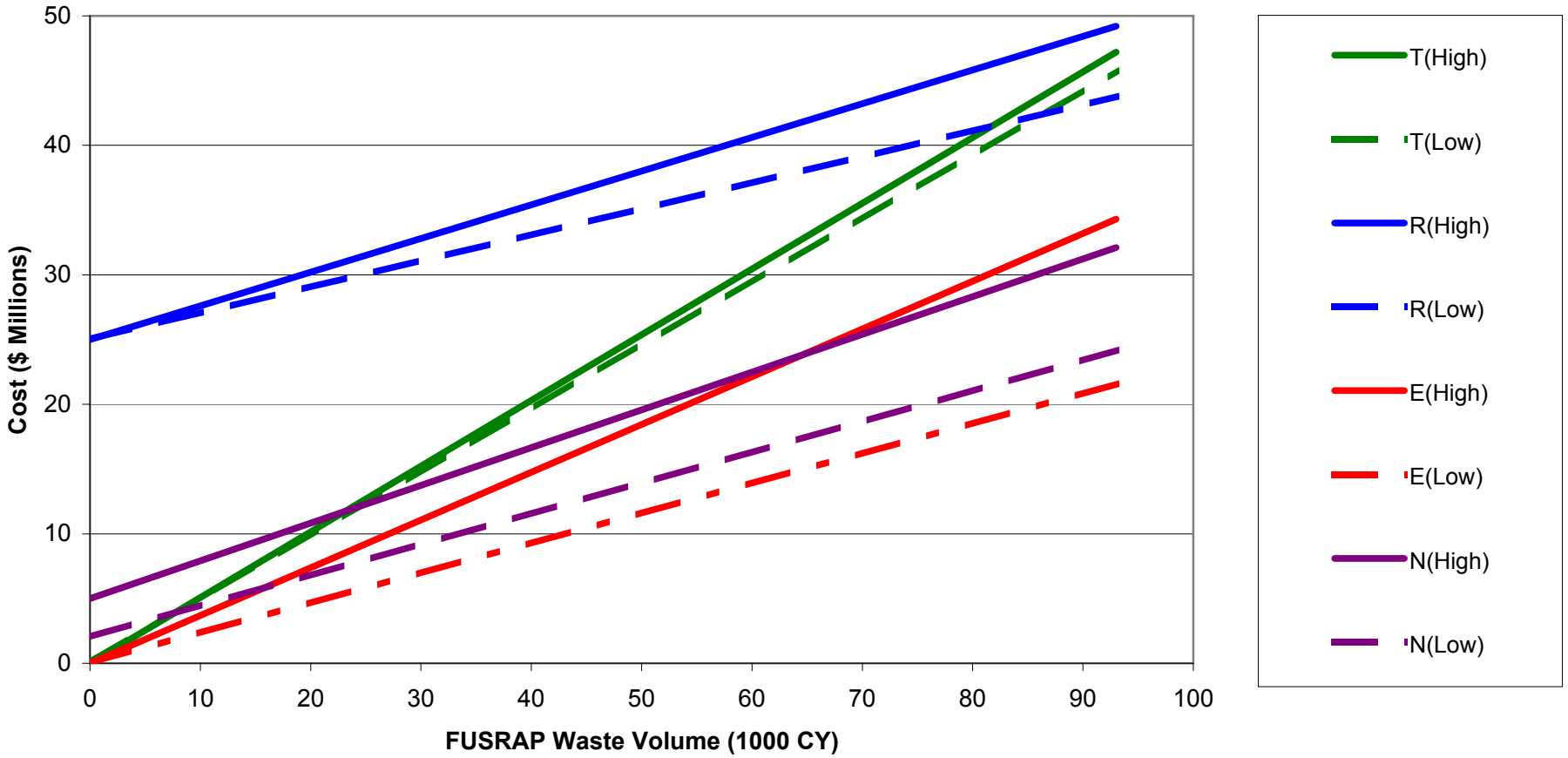
FIGURE 1

SITE LOCATION MAP

ALTERNATIVE SOIL TRANSPORTATION ROUTES

MWH

Figure 2
Luckey FUSRAP Site Transportation Alternatives Assessment
Cost Sensitivity to Changes in Waste Volume



T = Trucking (Alternative H)
R = Railroad (Alternative G)
E = Existing Transfer Station (Alternatives A, B, and F)
N = New Transfer Station (Alternatives C, D, and E)

M:\jobs\1359\009\11\wp\rpt\97_Figure 2 CostWaste_Sens_Grph.xls